Additional e-mails from ReCommunity

E-Mail from ReCommunity 7-26-12

ReCommunity does have additional sampling data that we are happy to provide. ReCommunity has early sampling and testing data for these trace metals. Initially ReCommunity was sourcing their material from RDF facilities, as that was the most readily available material to them. Unfortunately – the RDF material processing utilized hammer mill shredding, which tends to cross-contaminate fibers with trace metals. While ReCommunity then processed the RDF-sourced material as they would ReEngineered Feedstock, the initial hammer-mill shredding reduced the size and intermingled all materials at a level that makes it impossible to fully recover the feedstock to pre-hammer mill shredded conditions.

Notwithstanding the difference in material, as the metal concentrations were still comparable to coal based on EPA's published data for traditional fuels, ReCommunity is confident that these levels will be reduced when the source material is unprocessed trash, which can then be fully subject to the full-scale ReEngineered Feedstock processing and treatment. ReCommunity believes that further reductions will simply add to a comfortable safety margin. ReCommunity also notes that in its initial testing, the variability of the RDF material was very high, indicating that only with significant processing and treatment, comparable to the ReEngineered Feedstock process, can the legitimacy criteria be consistently met in terms of the metal contaminant levels.

Contaminant	EPA published data range – coal (ppm)	ReEngineered Feedstock range (ppm)
Metals		
Antimony	0.5-10	ND-11
Cadmium	0.1-3	ND-1
Lead	2-80	1-36
Manganese	5-300	2-72

Optical sorting of the non-fiber stream is the initial tool for removal of PVC, and chlorine compounds are further removed through the thermal treatment of the plastics. These steps will reduce the contaminant level of chlorine compounds in the ReEngineered Feedstock product. Removal of non-combustible inerts and other prohibitives via fluidized bed separators/debris roll screens or equivalent technology will remove batteries, electronics, etc., which will further reduce trace metals contaminants.

ReCommunity does not have contaminant concentration data for the organic compounds that you requested. ReCommunity has conducted ambient air quality VOC analysis, so while we are providing you with that data, it is not of a similar form to the contaminant concentration data that you have released for coal. ReCommunity believes that the relatively low levels of VOCs emitted by ReEngineered Feedstock indicate safe and comparable handling relative to coal with respect to VOCs. Of the VOC data you requested, copied below are the results of ReCommunity's ambient air quality analysis for those constituents responsive to your request. Again, these are ambient air quality results, in ppb (volume),

and thus are not of the same nature as the data you published on coal composition, but we wished to be responsive, and hope this data is helpful to you.

The control sample was ambient air, to which ReEngineered Feedstock compares favorably. We would also note that since ReEngineered Feedstock has a relatively high heating value, and will be co-fired at a ratio of less than thirty percent with coal, the resulting high combustion temperatures will destroy any products of incomplete combustion which are typical of MSW and RDF combustion.

Non-metallic HAPS	Control (ppb)	ReEngineered Feedstock range (ppb)
Benzene	0.58	ND-0.59
Ethyl Benzene	ND	ND
Styrene	ND	ND
Toluene	0.35	ND-0.31
Xylenes	0.41	ND-0.51
Others		
Methylene Chloride	ND	ND

We thank you again for your cooperation in this matter, please let us know if you have any questions.

E-Mail from ReCommunity 7-27-12

We wanted to provide you with a short summary of our discussion today, as you requested. You specifically asked us for our understanding of the chemical processes behind dioxin production, and how ReCommunity expects ReEngineered Feedstock to perform compared to current 100% coal fired boilers.

As you know, the dioxin formation process involves complicated mechanisms in fuel combustion. In the case of coal fired boilers, dioxins are predominately produced by the so-called *de novo* reaction, which requires the following four basic necessary conditions, namely:

- Cl_2 as a chlorine donor,
- polyphenols as chlorine receptors,
- optimal temperature, and
- catalysts (in fly ash).

Because ReEngineered Feedstock will be co-fired with coal and contains sorbents that remove chlorine from the flue gas, it is reasonable to expect reductions in dioxin formation compared to 100% coal firings for the reasons we discussed, which are summarized below.

Chlorine donor - molecular chlorine availability for dioxin formation is reduced:

1. Sorbents in ReEngineered Feedstock drive Cl_2 removal

The formation of dioxins and furans (PCDD/F) requires a chlorine donor –elemental chlorine (Cl_2). It has been well documented from lab tests and field experience that sulfur inhibits formation of Cl_2. Sulfur inhibition can be explained by the chemical reaction

$Cl_2 + SO_2 + H_2O = 2HCl + SO_3$

During ReEngineered Feedstock co-firing, SO_3 will be absorbed more easily by the sorbent component of ReEngineered Feedstock, which also neutralizes HCl. As a result, the above reaction shifts towards the right (improving consumption of Cl_2). Since Cl_2 concentration in the flue gas is reduced, its availability to PCDD/F formation is reduced.

2. Cl2 is removed prior to temperatures that allow dioxin formation

Importantly, ReEngineered Feedstock delivers sorbent to be chemically available both in the boiler and immediately after the flue gas exits the boiler. This compares favorably to traditional after-treatment technologies that remove chlorine after the flue gas temperature has dropped into the dioxin formation ideal range (300-600° F). ReEngineered Feedstock's sorbent is available earlier in the combustion process, when temperatures far exceed that of the ideal dioxin formation, at around 1,800-2,200° F. As a result, there is likely to be far less chlorine actually available for dioxin formation at the later stage in the combustion process where PCDD/F are most likely to be formed. This should lead to dioxin formation below that of a similar 100% coal fired boiler.

3. Molar Cl/S ratios of ReEngineered Feedstock in typical 20-30% cofiring indicate successful inhibition of dioxin formation

Extensive research has demonstrated that when the S/Cl ratio is greater than about 3, the inhibition of PCDD/F formation by sulfur is consistent. In a typical cofiring scenario, ReCommunity estimates that the total fuel mixture's S/Cl molar ratio would be about 24. This ratio is significantly above the commonly required 3 to suggest significant inhibition of sulfur on PCDD/F formation. Note that with decrease in Cl in ReEngineered Feedstock due to the thermal treatment and PVC removal, this S/Cl goes even higher.

While we believe that those factors alone are indicative of reductions in dioxin formation, we would also note that ReEngineered Feedstock is also likely to reduce chlorine receptor availability, and catalyst concentrations in fly ash. Polyphenols are produced due to incomplete combustion. ReEngineered Feedstock is highly volatile and manufactured to proper sizes to achieve complete combustion. In fact, due to its high volatility, ReEngineered Feedstock promotes coal combustion and thus the possibility of the occurrence of a de novo synthesis is reduced. ReEngineered Feedstock also contains lower levels of the most effective catalysts for the *de novo* reaction, copper and iron. Compared to the coal Cu (1-240 ppm) and Fe (77-140,000 ppm) contents, ReEngineered Feedstock contains considerably less Cu (0-50 ppm) and Fe (0-100 ppm), and thus should contribute fewer catalysts in the fly ash to promote dioxin formation.

As a result, ReEngineered Feedstock is likely to reduce dioxin formation compared to facilities firing 100% coal.